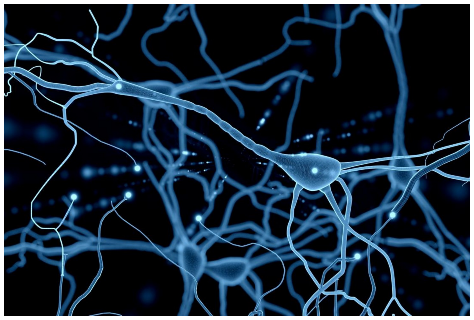
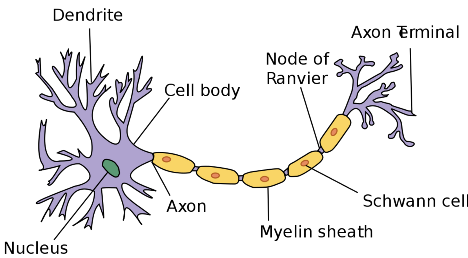
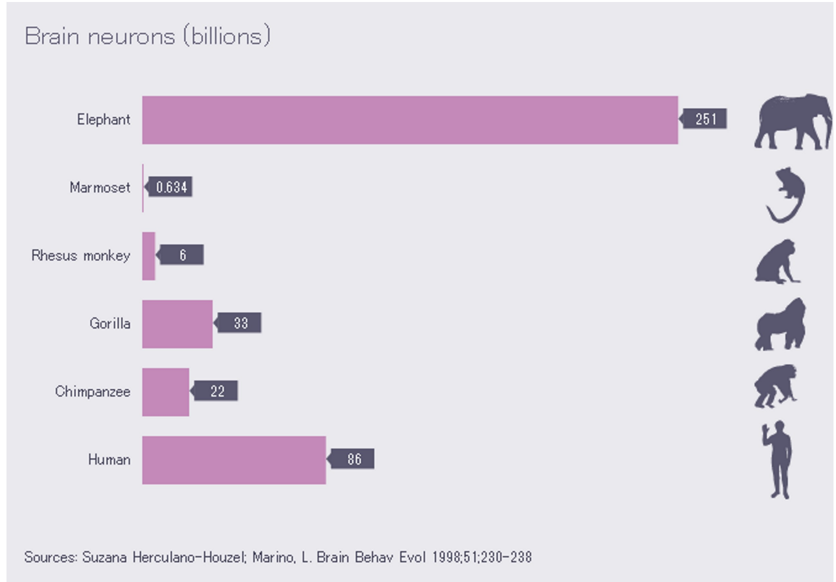
NeuralNetworks01

Thursday, April 2, 2020 12:04 AM





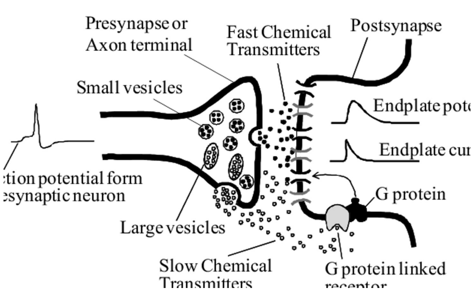


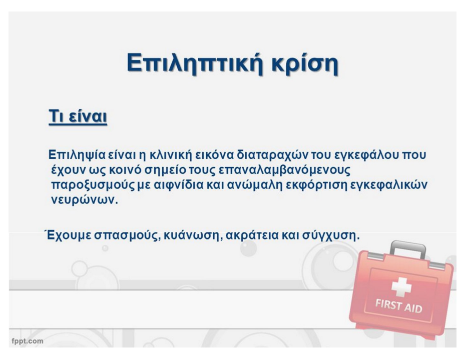
Cat	760,000,000 ~1×10^{13}	

African elephant	2.57×10^{11}	

Human	8.6×10^{10} ~1.5×10^{14}	

Ant	250,000	





Pirates (1986) 10800p BrRip x264 YIFY

Οι ψευδαισθήσεις εντοπίζονται λόγω έλλειψης ύπνου, έλλειψης τροφής, έλλειψης νερού ή αισθητηριακού αποκλεισμού (περιορισμός όρασης, ακοής ή άλλης αίσθησης)

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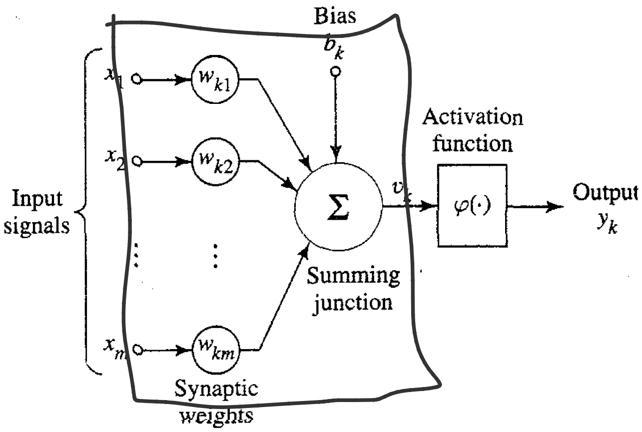
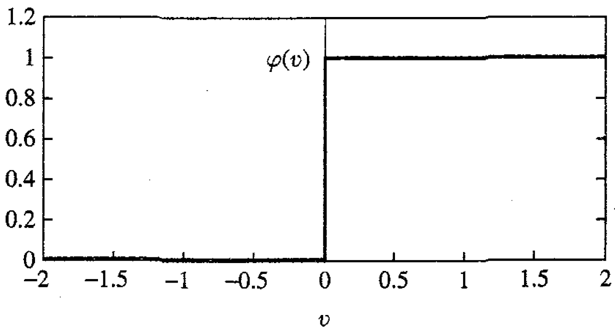


$$\boxed{u_k = \sum_{j=1}^{m} w_{kj} x_j}$$

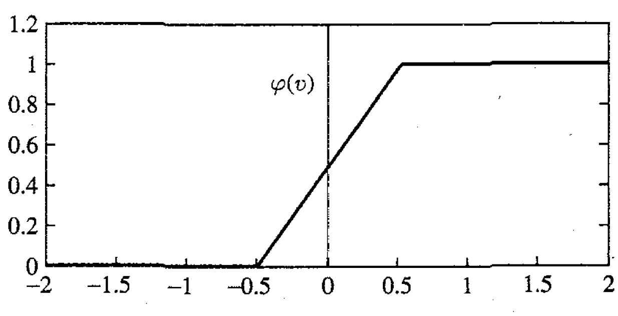
$$\boxed{y_k = \varphi(u_k + b_k)}$$

$$\varphi(v) = \begin{cases} 1 & \text{if } v \geq 0 \\ 0 & \text{if } v < 0 \end{cases}$$

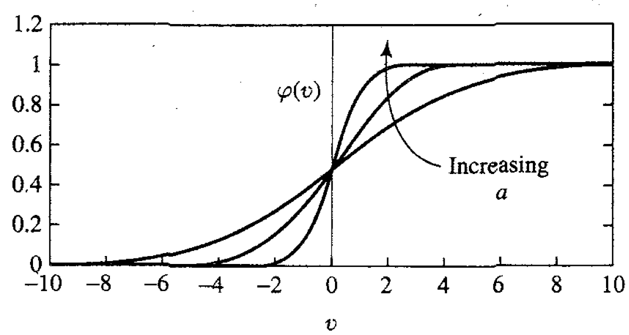


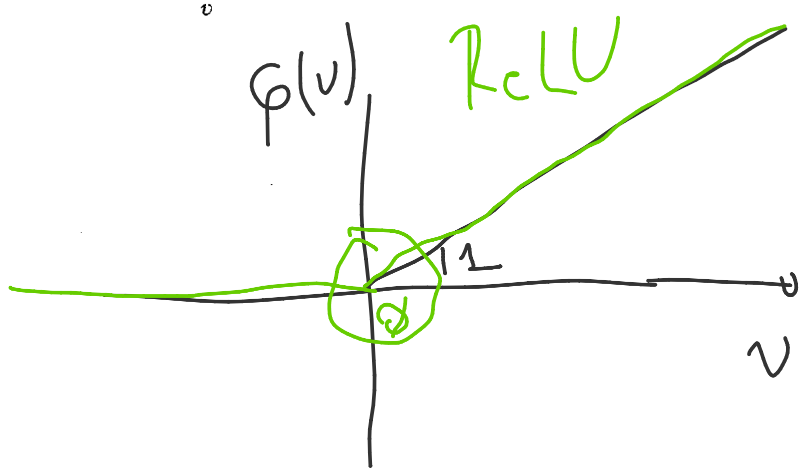
(a)

$$\varphi(v) = \begin{cases} 1, & v \geq +\frac{1}{2} \\ v, & +\frac{1}{2} > v > -\frac{1}{2} \\ 0, & v \leq -\frac{1}{2} \end{cases}$$



$$\boxed{\varphi(v) = \frac{1}{1 + \exp(-av)}}$$





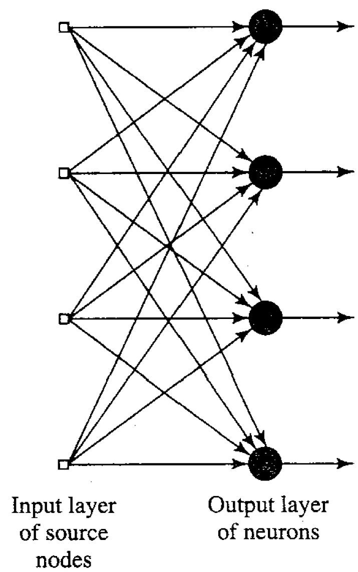


FIGURE 1.15 Feedforward or acyclic network with a single layer of neurons.

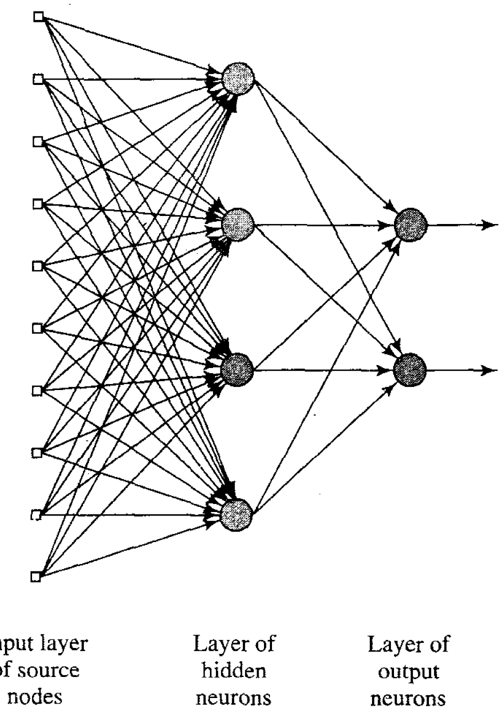


FIGURE 1.16 Fully connected feedforward or acyclic network with one hidden layer and one output layer.

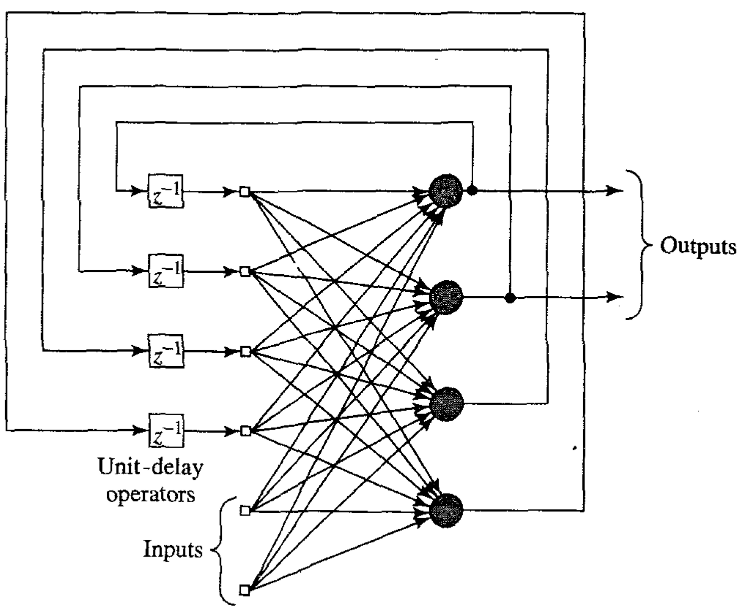
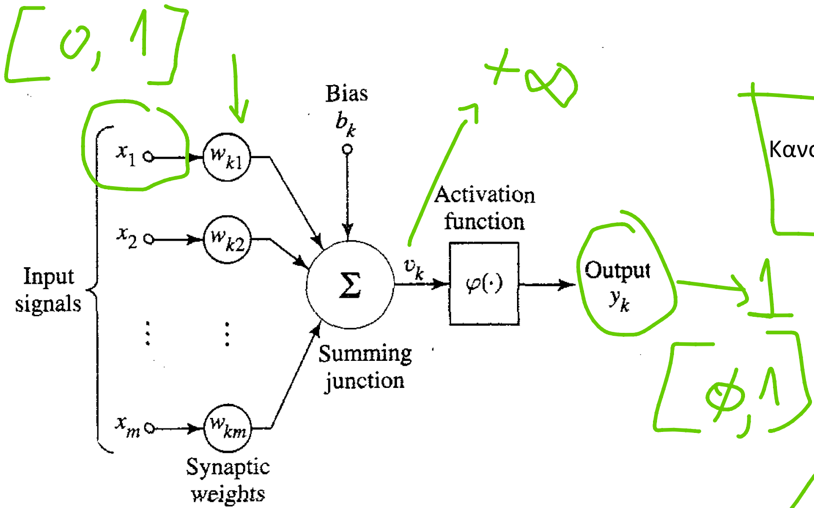


FIGURE 1.18 Recurrent network with hidden neurons.

The Organization of Behavior (1949, p.62):

Hebb

When an axon of cell A is near enough to excite a cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic changes take place in one or both cells such that A's efficiency as one of the cells firing B, is increased.



Κανόνας Hebb

$$\Delta w_{kj}(n) = F(y_k(n), x_j(n))$$

The simplest form of Hebbian learning is described by

$$\Delta w_{kj}(n) = \eta y_k(n) x_j(n)$$

μαθαίνω

$$\Delta w_{kj}(n) = F(y_k(n), x_j(n)) - g(w_{kj}(n-1), y_k(n))$$

λήθη

Αν δεν ξεχνάμε υπάρχει σοβαρό θέμα !!!

Απλοποιημένη σχέση

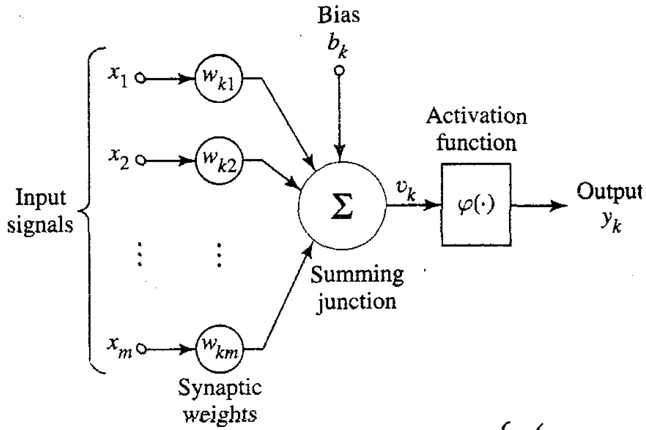
$$\Delta w_{kj}(n) = \eta y_k(n) x_j(n) - \alpha w_{kj}(n-1) \cdot y_k(n) =$$

$$= y_k(n)\left[\eta x_j(n) - \alpha w_{kj}(n-1)\right] =$$

$$= \eta y_k(n)\left[x_j(n) - \frac{\alpha}{\eta} w_{kj}(n-1)\right]$$

$+ \quad -$

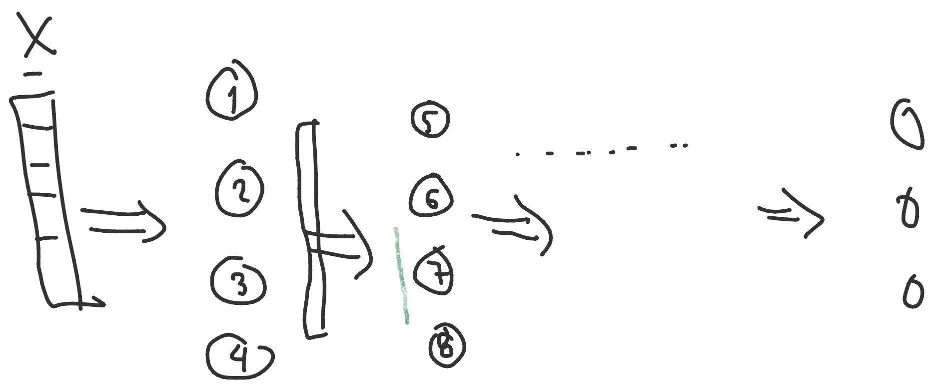
Ανταγωνιστική εκπαίδευση



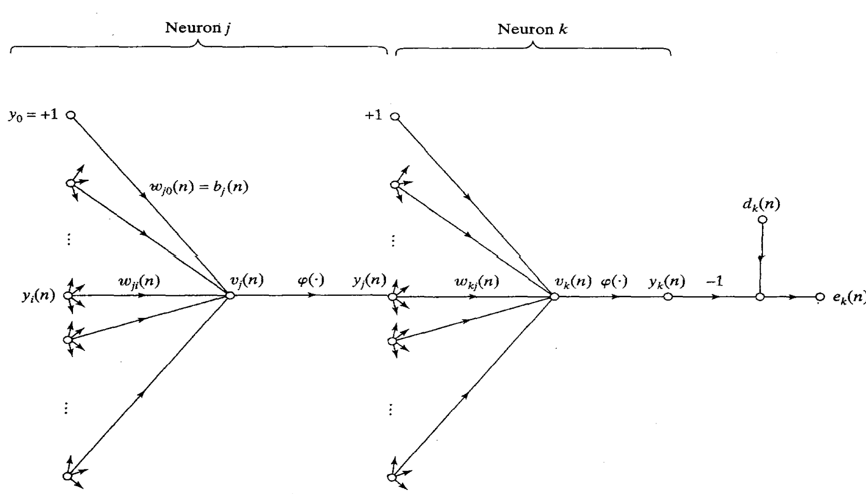
$$\boxed{\sum_j w_{kj} = 1 \quad \text{for all } k}$$

$$\boxed{\sum_j w_{kj}^2 = 1 \quad \text{for all } k}$$

$$\Delta w_{kj} = \begin{cases} \eta(x_j - w_{kj}) & \text{if neuron } k \text{ wins the competition} \\ 0 & \text{if neuron } k \text{ loses the competition} \end{cases}$$



Οπισθοδρομική διάδοση του σφάλματος - Error backpropagation

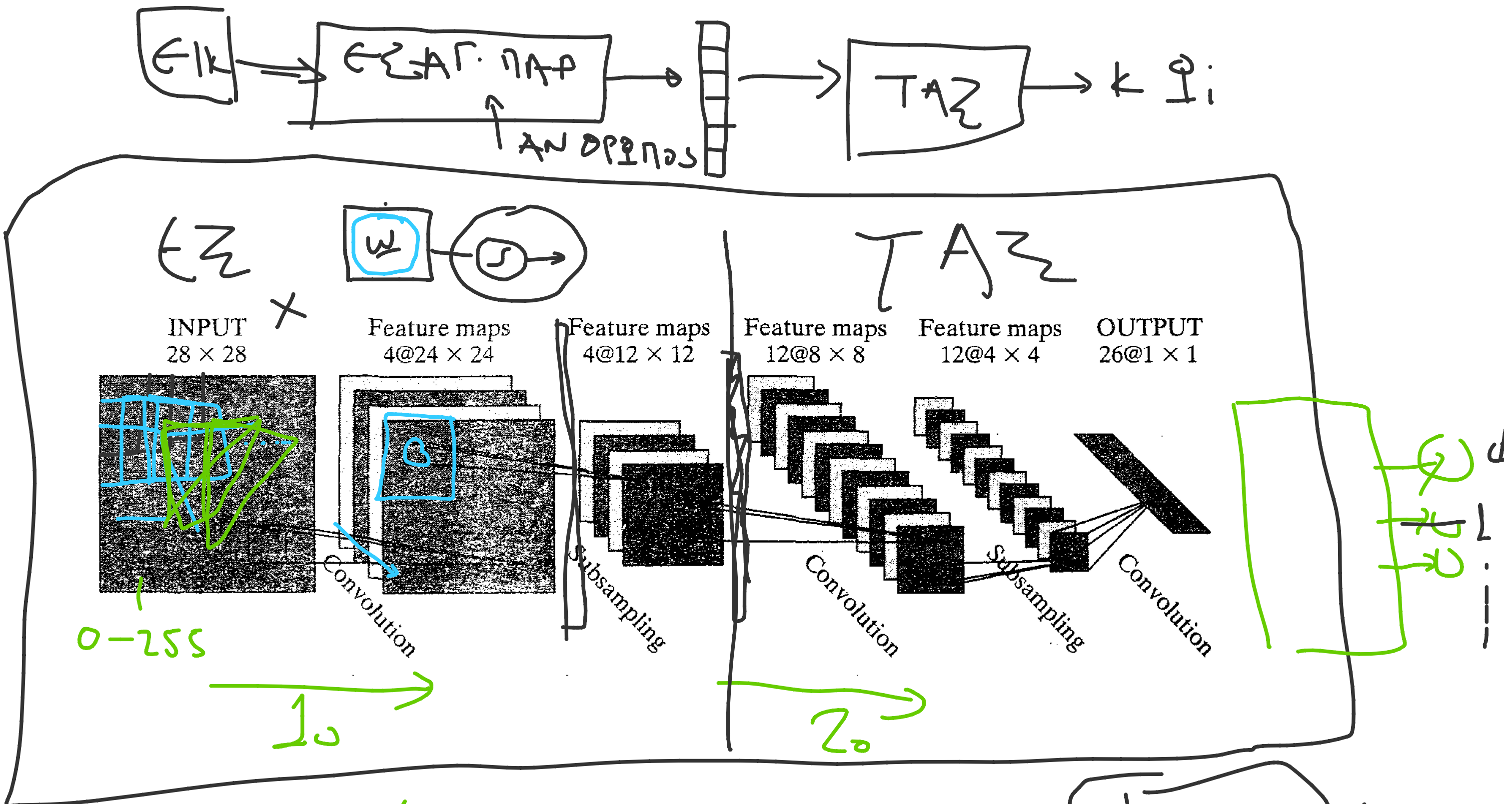


$$\Delta w_{ji}(n) = -\eta \frac{\partial \mathscr{E}(n)}{\partial w_{ji}(n)} \qquad \delta_j(n) = -\frac{\partial \mathscr{E}(n)}{\partial v_j(n)}$$

$\Delta w_{ji}(n) = \eta\delta_j(n)y_i(n)$ ΜΟΙΑΖΕΙ ΜΕ HEBBIAN

$$\delta_j(n) = \varphi_j'(v_j(n))\sum_k \delta_k(n)w_{kj}(n), \qquad \text{neuron } j \text{ is hidden}$$

$$\delta_j(n) = e_j(n)\varphi_j'(v_j(n)) \to \phi$$
$$= a[d_j(n) - o_j(n)]o_j(n)[1 - o_j(n)], \qquad \text{neuron } j \text{ is an output node}$$

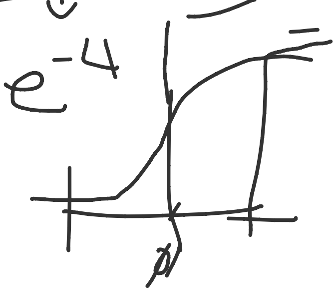


$x' = \dfrac{x - \langle x\rangle}{\sigma}$ $\quad \langle x'\rangle = \phi \quad \sigma^2 = 1$

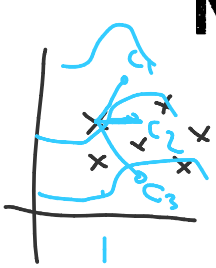
$y = \dfrac{1}{1 + e^{-\sum w_i x_i}}$ 0-255 0.01

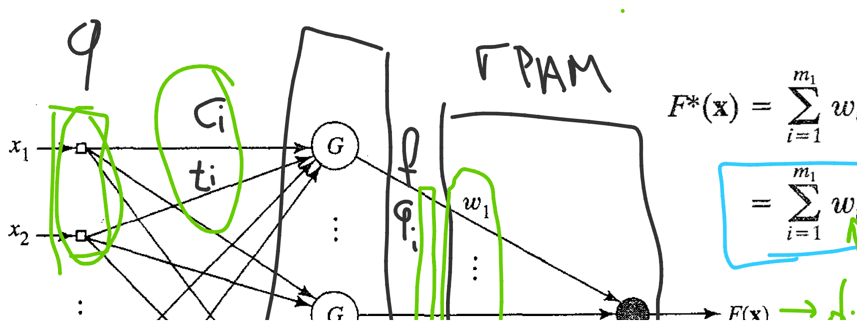
Radial-Basis Function Networks

$f(\|x - c_i\|)$ $\quad f(w^T \cdot x)$ $\quad \phi - e^{-4}$

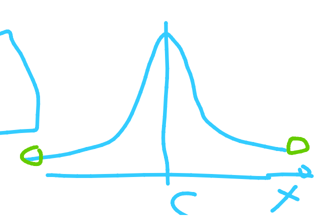


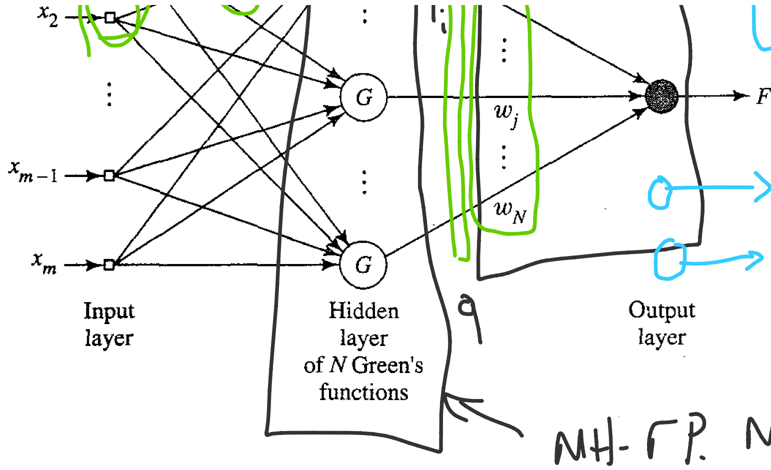
$$\varphi_i(\mathbf{x}) = G(\|\mathbf{x} - \mathbf{t}_i\|), \quad i = 1, 2, \ldots, m_1$$





$$F^*(\mathbf{x}) = \sum_{i=1}^{m_1} w_i G(\mathbf{x}, \mathbf{t}_i)$$
$$= \sum_{i=1}^{m_1} w_i G(\|\mathbf{x} - \mathbf{t}_i\|)$$





$$f(\boldsymbol{x}) = \exp\left(-\frac{1}{2\sigma_i^2}\|\boldsymbol{x}-\boldsymbol{c}_i\|^2\right)$$

$$f(\boldsymbol{x}) = \frac{\sigma^2}{\sigma^2+\|\boldsymbol{x}-\boldsymbol{c}_i\|^2}$$

ΜΗ-ΓΡ. ΜΕΤ

$$F^*(\mathbf{x}) = \sum_{i=1}^{m_1} w_i\varphi_i(\mathbf{x})$$

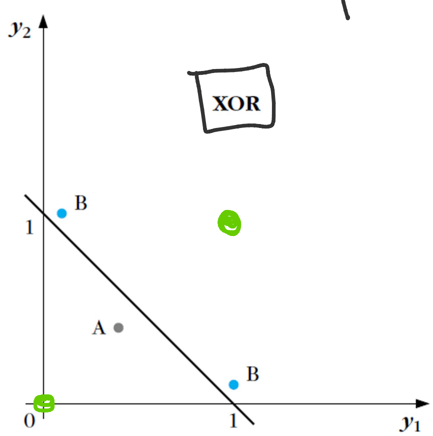
$$\nabla_w \mathcal{E}(F^*) = \underline{\emptyset} \qquad \nabla_{t_j} \mathcal{E}(F^*) = \emptyset$$

K-means !!!

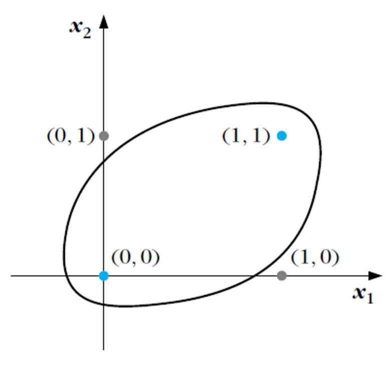
Εκπαίδευση RBF

$$\mathcal{E}(\underline{w},\underline{t}) = \mathcal{E}(F^*) = \sum_{i=1}^{N}\left(\underline{d_i} - \sum_{j=1}^{m_1} w_j G(\|\mathbf{x}_i - \mathbf{t}_j\|)\right)^2$$

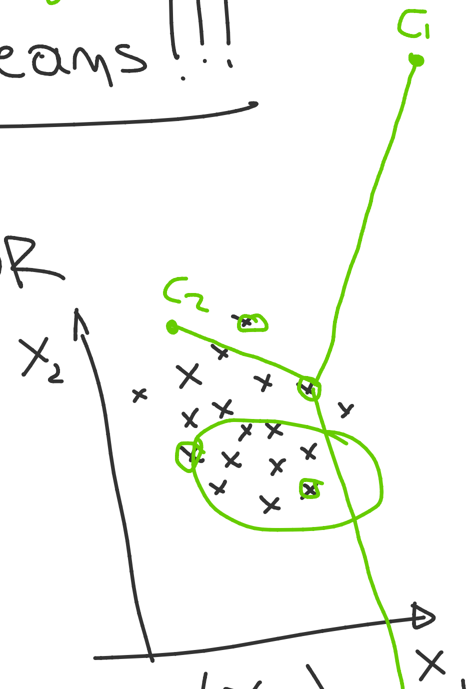
Το πρόβλημα της πύλης XOR



(a)



(b)



$$\underline{x} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$$

$(\underline{x})_N \longrightarrow \omega_1$

$(\underline{x})_N \longrightarrow \omega_2$

COVER

$\exists\ \underline{f}(\underline{x}) : \underline{z} = \underline{f}(\underline{x})$

$\longrightarrow (\underline{z})_M \quad M > N$

$y = \underline{w}^T \cdot \underline{x}$

$\forall_N\ \underline{x} \in \omega_1 \to y > 0$

$\underline{x} \in \omega_2 \to y < 0$

$y = \underline{w} \cdot \underline{x}$

A_N $\underline{x} \in \omega_1 \rightarrow y > 0$

$\underline{x} \in \omega_2 \rightarrow y < 0$

$(\underline{z})_M$

$y = \underline{w}^T \cdot \underline{z}$